CLAIMS

1. A memory element wherein recording information is written by injecting spin-polarized electrons comprising:

a spin conduction layer made of a spherical shell or cylindrical molecule material having a hollow, and wherein

the spin-polarized electrons are conducted by the spin conduction layer.

2. A memory element according to claim 1 comprising:

a first ferromagnetic layer wherein a magnetization direction is fixed;

a spin conduction layer made of a spherical shell molecule material having a hollow in which a paramagnetic material is included and having a given spin coherence length, which is formed over the first ferromagnetic layer; and

a second ferromagnetic layer formed on the spin conduction layer on the side opposite to the first ferromagnetic layer, wherein a magnetization direction is changed by the spin-polarized electrons, wherein

the recording information is written by changing the magnetization direction of the second ferromagnetic layer.

3. A memory element according to claim 2, wherein the spherical shell material constructing the spin conduction layer is carbon molecule fullerene.

4. A memory element according to claim 3, wherein the spherical shell molecule material is carbon molecule fullerene having a hollow sized from 0.1 nm to 50 nm.

5. A memory element according to claim 2, wherein a thickness of the spin conduction layer is from 0.5 nm to 5 μm.

6. A memory element according to claim 2, wherein the paramagnetic material included in the spherical shell molecule material is lanthanum (La), cesium (Cs), dysprosium (Dy), europium (Eu), or gadolinium (Gd).

7. A memory element according to claim 2, wherein the paramagnetic material included in the spherical shell molecule material is nitrogen (N) or phosphorous (P).

8. A memory element according to claim 2 comprising a spin arrayed layer between the first ferromagnetic layer and a second ferromagnetic layer.

9. A memory element according to claim 8, wherein the spin arrayed layer includes a dilute magnetic material.

10. A memory element according to claim 9, wherein the dilute magnetic material is made of at least one of (In, Mn)As, (Ga, Mn)As, (Cd, Mn)Te, (Zn, Mn)Te, and (Zn, Cr)Te.

11. A memory element according to claim 2, wherein the spherical shell molecule material includes a dilute magnetic material, and the spin conduction layer also functions as a spin arrayed layer.

12. A memory element according to claim 2, wherein a thickness of the first ferromagnetic layer is thicker than a thickness of the second ferromagnetic layer.

13. A memory element according to claim 2 comprising a magnetization fixed layer for fixing the magnetization direction of the first ferromagnetic layer on the opposite side of the first ferromagnetic layer to the spin conduction layer.

14. A memory element according to claim 13, wherein the magnetization fixed layer is made of an anti-ferromagnetic material.

15. A memory element according to claim 13, wherein the magnetization fixed layer also functions as an electrode.

16. A memory element according to claim 2, wherein a thickness of the second ferromagnetic layer is 5 atomic layers or less.

17. A memory element according to claim 2, wherein electrodes are formed at both faces respectively, and the electrodes are made of a paramagnetic metal material.

18. A memory element according to claim 1, wherein a writing line for injecting the spin-polarized electrons is connected to the second ferromagnetic layer.

19. A memory element according to claim 2, wherein a cell area is from 0.5 nm^2 to 5 μm^2.

20. A memory element according to claim 2, wherein the recording information is read by utilizing giant magnetoresistive effects generated in applying a current.

21. A memory element according to claim 2, wherein the recording information is read by illuminating the second ferromagnetic layer with light, and utilizing magnetic Kerr effect then generated.

22. A memory element according to claim 1 comprising:

first and second ferromagnetic layers wherein a magnetization direction change of at least one thereof is induced by injecting spin-polarized electrons; and

a spin conduction layer constructed from at least part of a hollow cylindrical molecule arranged by setting its axis direction to a laminating direction of the first and the second ferromagnetic layers, which is provided between the first ferromagnetic layer and the second ferromagnetic layer to shield magnetic interaction thereof and which conducts the spin-polarized

electrons.

23. A memory element according to claim 22, wherein a central part in the axis direction of the cylindrical molecule functions as the spin conduction layer, and the first ferromagnetic layer and the second ferromagnetic layer are included in one end and the other end, respectively.

24. A memory element according to claim 22, wherein a molecule of the cylindrical molecule is a composition unit of the element.

25. A memory element according to claim 22, wherein the spin conduction layer made of the cylindrical molecule has a length in its axis direction which is shorter than its spin coherence length at operation temperatures.

26. A memory element according to claim 22, wherein the spin conduction layer made of the cylindrical molecule includes other molecule or atom in a hollow part.

27. A memory element according to claim 22 comprising a spin arrayed layer between the first ferromagnetic layer and the second ferromagnetic layer.

28. A memory element according to claim 27, wherein the spin arrayed layer includes a dilute magnetic material.

29. A memory element according to claim 28, wherein the dilute magnetic material is made of at least one of (In, Mn)As, (Ga, Mn)As, (Cd, Mn)Te, (Zn, Mn)Te, and (Zn, Cr)Te.

30. A memory element according to claim 26, wherein a spin coherence length of the molecule or the atom included in the hollow part at operation temperatures is longer than the length of the spin conduction layer in the axis direction of the cylindrical molecule.

31. A memory element according to claim 22, wherein the cylindrical molecule is a carbon nanotube.

32. A memory device constructed from an arrayed plurality of memory elements, wherein

the memory element comprises a spin conduction layer made of a spherical shell or cylindrical molecule material having a hollow, and spin-polarized electrons are conducted by the spin conduction layer.

33. A memory device according to claim 32, wherein the memory element comprises:

a first ferromagnetic layer wherein a magnetization direction is fixed;

a spin conduction layer made of a spherical shell molecule material having a hollow in which a paramagnetic material is included and having a

given spin coherence length, which is formed over the first ferromagnetic layer; and

a second ferromagnetic layer formed on the spin conduction layer on the side opposite to the first ferromagnetic layer, wherein a magnetization direction is changed by the spin-polarized electrons, wherein

recording information is written by changing the magnetization direction of the second ferromagnetic layer.

34. A memory device according to claim 33, wherein the spherical shell molecule material constructing the spin conduction layer is carbon molecule fullerene.

35. A memory device according to claim 32, wherein the memory element comprises:

first and second ferromagnetic layers wherein a magnetization direction change of at least one thereof is induced by injecting the spin-polarized electrons; and

a spin conduction layer constructed from at least part of a hollow cylindrical molecule arranged by setting its axis direction to a laminating direction of the first and the second ferromagnetic layers, which is provided between the first ferromagnetic layer and the second ferromagnetic layer to shield magnetic interaction thereof and which conducts the spin-polarized electrons.

36. A memory device according to claim 35, wherein the memory

elements are integrated by being arrayed by aligning the axis directions of the cylindrical molecules.